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REPRODUCTIVE STATUS OF AN UPLAND POPULATION OF MASKED SHREWS[1]

THOMAS J. ANDERSON,[2] Department of Zoology, Miami University, Oxford OH 45056

Abstract. Masked shrew (*Sorex cinereus* Kerr) populations in upland hardwood forests of Upper Michigan were studied to determine their breeding status during the dry year of 1976. These populations lacked pregnant adult females and the younger age classes of juveniles. Other age/sex groups were well represented when conditions were moist. Apparently, masked shrews do not breed in upland hardwoods during dry conditions and may entirely abandon uplands during excessively dry periods.

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The masked shrew (*Sorex cinereus* Kerr) occupies a variety of habitats including bogs, swamps, and upland forest and grassland (Manville 1949, Getz 1961, Richens 1974, Laundre 1975, Robinson and Werner 1975, Wrigley *et al* 1979). Microhabitat analyses indicate that soil moisture is a critical limiting factor in masked shrew distribution (Pruitt 1959, Getz 1961, Spencer and Pettus 1966, Okhartina 1977). Depending on topographic and edaphic conditions, certain areas may be continuously, regularly, or sporadically too dry to be occupied by masked shrews.

In Minnesota masked shrews occurred in swamps, streambeds, and lake-sides but did not penetrate far into surrounding uplands (Quimby 1943). Upland hardwoods may maintain stable mesic conditions throughout a particular year (Pruitt 1953) but moisture conditions may vary between years. Occasional dry years may restrict masked shrew populations to the vicinity of moist lowlands by inhibiting breeding and thus blocking colonization.

This study examines the reproductive status of masked shrew populations in upland hardwoods bordering lowlands in a dry year to determine whether breeding occurred. Lack of breeding evidence would suggest that masked shrew distribution is limited to the vicinity of moist lowlands in dry years.

METHODS

The study was conducted in the 6800 ha McCormick Experimental Forest, located north of the township of Champion and south of the Huron Mountains in Marquette and Baraga Counties in Upper Michigan. The study period was from January through September 1976. The study area was northern hardwood forest, dominated by sugar maple (*Acer saccharum*), red maple (*A. rubrum*), and yellow birch (*Betula lutea*), with some red oak (*Quercus rubra*), white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), and balsam fir (*Abies balsamea*). All trapping plots were in hardwood forest within 150 m of white spruce (*Picea glauca*) or black spruce (*P. mariana*) lowland forests, white cedar (*Thuja occidentalis*) swamps or *Sphagnum* bogs.

Eight 0.25 ha trapping plots each consisted of 25 water-filled pitfall traps positioned in a 5 x 5 grid pattern with 10 m between traps. Eight 2-week trapping sessions were held (table 1). Snap-traps were used instead of pitfalls in January and March. After mid-June, two plots were trapped per session. Some of the plots were trapped early and again later in the year.

Rainfall during the months of May through September was 29.7 mm (62%) below normal (U.S. Dept. of Commerce 1976). No measurable rain fell during the entire month of May, making the ground surface in the upland hardwood forest unusually dry. Only sporadic rain fell during the remainder of the summer and conditions remained extremely dry.

Sex was determined by dissection. Females that were lactating or had visible embryos in the uterus were classed as breeding, as were males with enlarged testes. Skulls were cleaned, and age was determined by the Rudd method (1955). Age classes consisted of sub-

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[2]Present address: Dalton, Dalton, Newport; 3605 Warrensville Center Road, Cleveland OH 44122.

adults (groups 1 and 2) and adults (groups 3 and 4).

RESULTS

Total captures and captures per 100 trap-nights were high in summer and low during the winter (table 1). Buckner (1966) reported similar trends for masked shrews in tamarack (*Larix laricina*) bogs in Manitoba. In my study, no captures were made during the 300 trap-nights in May, but the same plot yielded 8 shrews in August.

TABLE 1

Trapping methodology and Sorex cinereus captures.

Month	Plot No.	Trap-nights	Total Capture	Captures/100 Trap-nights
Jan	1	300	1	0.3
Mar	2	225	1	0.4
May	3	300	0	0
June	4	375	5	1.3
June	1,5	600	18	3.0
July	2,6	700	21	3.0
Aug	3,7	750	15	2.0
Sept	4,8	750	4	0.5

The age distribution of captures showed few group 1 shrews ($\leq$4 months old) (table 2). I captured no shrews younger than group 1+ (3 to 4 months old), although shrews younger than group 1+ are trappable. Buckner (1966) caught group 1 and 1− masked shrews in Manitoba tamarack bogs.

All adult males captured during the summer were in breeding condition (table 3). The one adult male captured in September was not breeding. Only 1 of 25 sub-adult males caught during the summer (4%) was in breeding condition. Seven of the 19 sub-adult females caught during the summer (37%) were lactating, and two were pregnant. All adult females captured during the summer were lactating, though no pregnant adult females were captured at any time (table 4). Females were much less abundant than males (25 females, 40 males).

TABLE 2

Age distribution of captures.

Month	Sub-Adult group 1	Sub-Adult group 2	Adult group 3	Adult group 4
Jan	0	1	0	0
Mar	0	1	0	0
May	0	0	0	0
June	1	14	7	1
July	0	14	5	2
Aug	4	11	0	0
Sept	0	1	3	0

TABLE 3

Breeding condition of males.

	Sub-Adult		Adult	
	captures	breeding	captures	breeding
Jan	0	0	0	0
Mar	1	0	0	0
May	0	0	0	0
June	9	1	5	5
July	7	0	7	7
Aug	9	0	0	0
Sept	1	0	1	0
Total	27	1	13	12

TABLE 4

Breeding condition of females.

	Sub-Adult			Adult		
	captures	lactating	pregnant	captures	lactating	pregnant
Jan	1	0	0	0	0	0
Mar	0	0	0	0	0	0
May	0	0	0	0	0	0
June	6	1	1	3	3	0
July	7	4	1	0	0	0
Aug	6	2	0	0	0	0
Sept	0	0	0	2	0	0
Total	20	7	2	5	3	0

DISCUSSION

The lack of captures of shrews during the May session indicated that at least some upland hardwood areas were intermittently occupied. Manville (1949) and Buckner (1966) caught masked shrews in tamarack bogs during May in Upper Michigan and Manitoba, respectively. June populations in my study were high in these areas and included a considerable number of adults. It appears that shrews either avoided particularly dry upland areas during the May drought (by constricting their activity range within the upland hardwoods), or they migrated the relatively short distance to nearby lowlands that afforded suitable moisture conditions. Sarrazin and Bider (1973) showed that masked shrews are highly mobile in spruce and birch forests bordering bogs and may in fact be vagrant. Thus, the occasional abandonment or re-occupation of areas which are transiently favorable may occur rapidly, as conditions dictate.

The low proportion of females and the absence of pregnant adults were significant indicators of the breeding status of the upland population. Even if females considerably restricted their activity ranges during pregnancy, it is unlikely that they would restrict them to less than the 10 m intervals between traps. Thus, the low number of females captured and the lack of pregnant adults reflect their actual numbers and not a trapping bias. This situation might be expected to occur if dry upland areas were unsuitable for nesting burrows —as was found for *Blarina brevicauda* by Pruitt (1959).

The youngest shrews captured in my study were well beyond the age of weaning (see Rudd 1955). If shrews were born and raised in my study area, then they should have entered the traps at an earlier age. For example, they should have been captured once they began foraging away from the nest. This observation suggests that no litters were raised within the study area during the dry period.

The upland population studied cannot be considered an independent, breeding population. Although breeding males were well represented, the few adult females captured had probably weaned young elsewhere (assumedly in the nearby moist lowlands). In times of unfavorable or dry conditions, upland hardwoods harbor no, or only a few, masked shrews. It appears that a stable lowland population expands (geographically) into the surrounding uplands when conditions there are favorable, and then contracts during unfavorably dry conditions. This change may occur by mass movements of apparently vagrant shrews. It remains to be determined whether masked shrews breed in uplands during wet or normal years and eventually penetrate deeply into these upland forests.

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